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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/856,211	05/18/2001	Vincent Derycke	33585	6755

7590 08/15/2002

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EXAMINER
SONG, MATTHEW J

ART UNIT	PAPER NUMBER
1765	7

DATE MAILED: 08/15/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

AS-7

Office Action Summary	Application No.	Applicant(s)	
	09/856,211	DERYCKE ET AL.	
	Examiner	Art Unit	
	Matthew J Song	1765	

-- Th MAILING DATE of this communication appears on the cover she t with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____ .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-14* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-14* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *18 May 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) *4,5* .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1 and 4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yoder (US 5,225,366) in view of Dreifus et al (US 5,420,443).

Yoder discloses atomic layer epitaxy of single crystalline diamond thin films by exposing a plurality of diamond like substrates to a halocarbon reactant gas and a hydrocarbon reactant gas at substrate temperatures between 300°C and 650°C and the time to grow an individual atom layer is $25x10^{-6}$ seconds (abstract and example 1). Yoder also discloses single crystalline substrates having lattice constants closely matched to that of diamond can be used, such as copper for single crystalline diamond growth (col 9, ln 20-45). Yoder also discloses 100% nucleation coverage, this reads on applicant's extends closely over the totality of the substrate (col 4, ln 50-65).

Yoder discloses a substrate having a lattice constant matched to that of diamond can be used. Yoder does not disclose a SiC substrate.

In a method of fabricating microelectronic structures having diamond structure on a nondiamond structure, Dreifus et al teaches a highly oriented diamond film formed on a non-diamond substrate and the substrate may be a single crystal substrate of a material having a

relatively close lattice match to diamond, such as β-SiC or copper which supports diamond growth, where lattice match refers to the difference between the lattice constant of diamond and SiC (col 10, ln30-50 and col 15, ln 15-45).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Yoder with Dreifus et al's SiC substrate because SiC has a close lattice match promoting single crystal growth.

3. Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yoder (US 5,225,366) in view of Dreifus et al (US 5,420,443) as applied to claim 1 above, and further in view of Powers et al (The American Physical Society, Physical Review 1991, Structural analysis of the β-SiC (100)-c(2x2) surface reconstruction by automated tensor low-energy electron diffraction).

The combination of Yoder and Dreifus et al teaches all of the limitations of claim 2, except a monocrystalline SiC in cubic phase formed on a platelet of Si.

In a structural analysis of SiC, Powers et al teaches β-SiC (100) samples were 4-6 micrometer thick films grown on Si wafer, this reads on applicant's platelet. Powers et al also teaches a better order c(2x2) surface could be produced by exposure of a (2x1) SiC surface to C_2H_4 (col 5 and 6). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Yoder and Dreifus et al with Powers et al's SiC film on a Si substrate because the SiC is better ordered.

4. Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yoder (US 5,225,366) in view of Dreifus et al (US 5,420,443) as applied to claim 1 above, and further in view of

Kackell et al (Diamond and Related Materials 6 (1997) pg 1346-1348, Polytypism and surface structure of SiC)

The combination of Yoder and Dreifus et al teaches all of the limitations of claim 3 including a cubic SiC substrate, as discussed previously, except SiC substrate being a platelet of monocrystalline SiC in hexagonal phase.

In a teaching of the surface structure of SiC, Kackell et al teaches Si-terminated SiC (111) is qualitatively equivalent to Si-terminated 2H SiC(0001) (col 1 and 3).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Yoder and Dreifus et al with Kackell et al because cubic and hexagonal SiC are taught to be equivalents. (MPEP 2144.06)

5. Claims 1-2, 4-6 and 8-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Powers et al (The American Physical Society, Physical Review 1991, Structural analysis of the β-SiC (100)-c(2x2) surface reconstruction by automated tensor low-energy electron diffraction) in view of Liu et al (US 5,516,500).

Powers et al discloses a β-SiC (100) surface terminating in a layer of silicon atoms (col 1) and two different routes to prepare a c(2x2) surface reconstruction, where the first method required a removal of surface silicon from a (2x1) surface by high temperature annealing in UHV and at approximately 1300 K, the (2x1) to c(2x2) conversion required 10-15 minutes of annealing (col 5). Powers et al also discloses an ordered c(2x2) surface could be produced by exposure of a (2x1) surface at 1125 K to 100L C_2H_4 (col 6). Powers et al also discloses the

c(2x2) surface terminates with a staggered array of C_2 groups in silicon bridge sites (col 10) and the surface carbons are sp^2 hybridized (col 8).

Powers et al is silent to an annealing of the substrate to transform the place of carbon-carbon dimmers into a plane of carbon-carbon dimmers of sp^3 configuration.

In a method of forming diamond materials by rapid heating of carbon containing materials, Lui et al teaches a carbon material is disposed between two electrodes and the temperature of the carbon containing material is elevated by at least 1000°C (col 4, ln 15-30 and claim 3). Lui et al also teaches a duration and number of iterations required to effect a synthesis of a diamond material from a carbon containing material may be empirically determined (col 4, ln 35-55). Lui et al also discloses the diamond phase is thermodynamically stable and has an sp^3 configuration (col 1, ln 25-30 and col 2, ln 50-60). Lui et al also discloses a coating of the surface of a substrate with a thick or thin film diamond material is useful on a cutting tool insert (col 2, ln 45-60 and col 5, ln 15-30).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Powers et al with Lui et al's rapid heating to form a film of diamond because a diamond film is useful on a cutting tool insert.

The combination of Powers et al and Lui et al is silent to the diamond film is a monoatomic layer. It is inherent to the combination of Powers et al and Lui et al to form a monoatomic layer because the combination of Powers et al and Lui et al teaches a similar substrate as applicant, which is annealed as taught by applicant.

Referring to claims 1-2 and 4, the combination of Powers et al and Lui et al teaches a β-SiC on a Si wafer, this reads on applicant's platelet, and annealing a substrate to form a thick film of diamond for a desired number of iterations.

Referring to claim 5, the combination of Powers et al and Lui et al teaches a SiC c(2x2) substrate and annealing to form a single crystalline diamond film.

Referring to claim 6, the combination of Powers et al and Lui et al teaches a SiC substrate with a face terminated by a layer of Si.

Referring to claim 8, the combination of Powers et al and Lui et al teaches annealing at 1300°K.

Referring to claim 9-10, the combination of Powers et al and Lui et al teaches exposing a substrate to C_2H_4.

Referring to claim 11, the combination of Powers et al and Lui et al teaches a temperature of greater than 1000°C, this reads on applicant's 1250°C, if it does not read on applicant's 1250°C then it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Powers et al and Lui et al by optimizing the temperature by conducting routine experimentation because temperature is a result effective variable. The combination of Powers et al and Lui et al is silent to the annealing time being greater than or about equal to 25 minutes. The combination of Powers et al and Lui et al teaches the number of iterations and duration can be empirically determined to synthesis materials. It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination Powers et al and Lui et al by optimizing the annealing time by conducting routine experimentation because time is a result effective variable.

6. Claims 3, 7 and 12-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Powers et al (The American Physical Society, Physical Review 1991, Structural analysis of the β-SiC (100)-c(2x2) surface reconstruction by automated tensor low-energy electron diffraction) in view of Liu et al (US 5,516,500) as applied to claim 5 above, and further in view of Kackell et al (Diamond and Related Materials 6 (1997) pg 1346-1348, Polytypism and surface structure of SiC).

The combination of Powers et al and Lui et al teaches all of the limitations of claim 7, as discussed previously, except the substrate is a SiC platelet in hexagonal phase with a face terminated by a layer of Si.

In a teaching of the surface structure of SiC, Kackell et al teaches Si-terminated SiC (111) is qualitatively equivalent to Si-terminated 2H SiC(0001) (col 1 and 3).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Powers et al and Lui et al with Kackell et al because cubic and hexagonal SiC are taught to be equivalents. (MPEP 2144.06)

Referring to claim 3 and 7, the combination of Powers et al, Lui et al and Kackell et al teaches a hexagonal SiC substrate.

Referring to claim 8, the combination of Powers et al, Lui et al and Kackell et al teaches annealing at 1300°K.

Referring to claim 13-14, the combination of Powers et al, Lui et al and Kackell et al teaches exposing a substrate to C_2H_4.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew J Song whose telephone number is 703-305-4953. The examiner can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Benjamin L Utech can be reached on 703-308-3868. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9310 for regular communications and 703-872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.

Matthew J Song
Examiner
Art Unit 1765

mjs
August 12, 2002

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